§10. Construction of High Power Neutral Beam Injection System for LHD

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The fabrication of *180keV, 15MW* neutral beam injection heating system for the LHD, which is the biggest facility using negative ion beam, was started in 1995. The system consists of two tangential beamlines, each of which has two negative ion sources. Most of the components of the first beamline including an ion source have been delivered in this year. The power supplies and the controlled system for the first injector have been installed. Their specifications are as follows;

Ion Source

Beam energy	180keV
H^- current	40A
Pulse width	10s
Beam extraction area*)	$25cm^W$ x $120cm^L$
*) *divided into 5 sections longitudinally.*	
Transparency	>38%
Accelerator	single stage (three grids system)

Beam Line

Vacuum chamber #1	dim.:	$3m^W$ x $2m^L$ x $3m^H$
	pump:	$360m^3/s$
Vacuum chamber #1	dim.:	$3.5m^\phi$ x $4.0m^H$
	pump:	$1000m^3/s$
Neutralizer		$3.5m^L$
Ion bending magnet	type:	180° reflection
Beam dump	type:	swirl tube array
	load:	$<16MW/m^2$

Power Supplies

Filament	14V	6kA	30s/300s
Arc	100V	5kA	20s/300s
Bias	10V	1kA	20s/300s
Extraction	-15kV	75A	10s/300s
Acceleration*)	-170kV	90A	10s/300s

*) *Accel. P.S. is common for two ion sources.*

Control system

Each beam line has its own control system so that it can be operated separately from the other. Advanced beam control such as pulse modulation, energy sweeping, and automatic conditioning is also considered in its design.

The second injector is under construction, and will be delivered next year. We are going to test and condition the ion sources at our test stand throughout the next year.

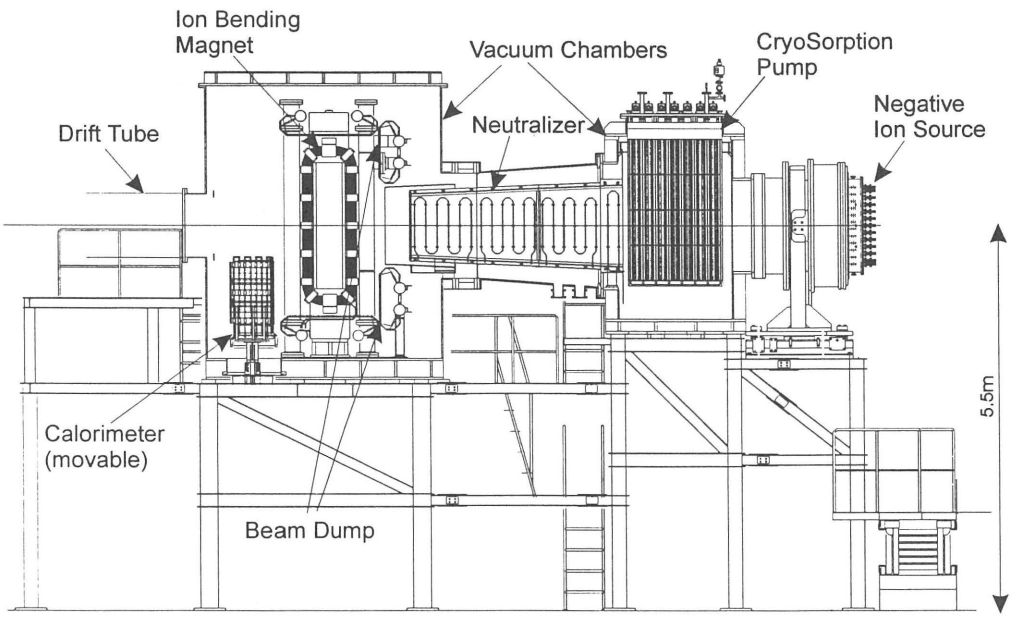

Fig. 1. Schematic view of beamline #1 (vertical view).